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(54) **SURFACE SIMPLIFICATION PRESERVING A SOLID VOLUME**

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Related U.S. Application Data

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(57) **ABSTRACT**

Computer systems may be used to generate and display objects represented by triangles defined by coordinates of vertices. The present invention generates coordinates of a simplified vertex based upon coordinates of vertices adjacent to a first vertex and to a second vertex that define an edge of the triangles. First, a set of triangles that are adjacent to the edge is identified, Second, a first volume associated with the set of triangles is calculated. Finally, the coordinates of the simplified vertex are calculated such that a second volume associated with the simplified vertex corresponds to the first volume.

In addition, a technique is presented that generates a second object which is a simplified representation of a first object. The technique begins by identifying first and second vertices that define an edge. The coordinates of a simplified vertex that corresponds to first and second vertices of the edge is determined. Error values and tolerance values are assigned to vertices. First error volumes corresponding to the vertices of a second vertices of the edge. The first error volumes are based upon the error values assigned to vertices of the first set of triangles. A second set of triangles that share the simplified vertex is identified and partitioned into a set of planar polygons. Second error volumes corresponding to vertices of the set of planar polygons are derived based upon the first error volumes. The second error volumes enclose the first error volumes. Third error volumes corresponding to vertices of the second set of triangles are derived. The third error volumes are based upon the first and second error volumes. The third volumes enclose both the first error volumes and the second error volumes. A tolerance volume corresponding to the simplified vertex is derived. Fianllym, the coordinates of the simplified vertex is stored in memory for subsequent reuse based upon a comparison operation of the third error volume corresponding to the simplified vertex and the tolerance volume.

24 Claims, 29 Drawing Sheets